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(51) International Patent Classification ⁶ : C12N 15/82, 15/54	A3	(11) International Publication Number: WO 98/46776 (43) International Publication Date: 22 October 1998 (22.10.98)
(21) International Application Number: PCT/US98/07114 (22) International Filing Date: 9 April 1998 (09.04.98) (30) Priority Data: 60/041,815 11 April 1997 (11.04.97) US (71) Applicant (for all designated States except US): CALGENE LLC [US/US]; 1920 Fifth Street, Davis, CA 95616 (US). (72) Inventor; and (75) Inventor/Applicant (for US only): DEHESH, Katayoon [US/US]; 521 Crownpointe Circle, Vacaville, CA 95687 (US). (74) Agent: SCHWEDLER, Carl, J.; Calgene LLC, 1920 Fifth Street, Davis, CA 95616 (US).		(81) Designated States: AU, BR, CA, JP, KR, MX, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> (88) Date of publication of the international search report: 6 April 2000 (06.04.00)
(54) Title: PLANT FATTY ACID SYNTHASES AND USE IN IMPROVED METHODS FOR PRODUCTION OF MEDIUM-CHAIN FATTY ACIDS (57) Abstract By this invention, compositions and methods of use related to β -ketoacyl-ACP synthase of special interest are synthases obtainable from <i>Cuphea</i> species. Amino acid and nucleic acid for synthase protein factors are provided, as well as methods to utilize such sequences in constructs for production of genetically engineered plants having altered fatty acid compositions. Of particular interest is the expression of synthase protein factors in conjunction with expression of plant medium-chain acyl-ACP thioesterases for production of increased levels and/or modified ratios of medium-chain fatty acids in oils of transgenic plant seeds.		

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Katayoon Dehesh
09/915/182

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INTERNATIONAL SEARCH REPORT

Int. l. Application No
PCT/US 98/07114

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C12N15/82 C12N15/54

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C12N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 06740 A (MAX PLANCK GESELLSCHAFT ;TOEPFFER REINHARD (DE); MARTINI NORBERT (D) 9 March 1995 see page 16, paragraph 1; claim 17 ---	15,22
P,X	LEONARD, J.M., ET AL.: "A Cuphea beta-ketoacyl-ACP synthase shifts the synthesis of fatty acids towards shorter chains in Arabidopsis seeds expressing Cuphea FatB thioesterases" THE PLANT JOURNAL, vol. 13, no. 5, March 1998, pages 621-628, XP002081429 see the whole document ----- -/--	15,22, 29-32

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

20 October 1998

Date of mailing of the international search report

02/11/1998

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INTERNATIONAL SEARCH REPORT

Inte. onal Application No
PCT/US 98/07114

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>DEHESH, K., ET AL.: "Production of hgh levels of 8:0 and 10:0 fatty acids in transgenic canola by overexpression of Ch FatB2, a thioesterase from Cuphea hookeriana"</p> <p>THE PLANT JOURNAL, vol. 9, no. 2, 1996, pages 167-172, XP002081430 see page 170, column 2, paragraph 2</p> <p style="text-align: center;">---</p>	15,22
A	<p>DEHESH K ET AL: "TWO NOVEL THIOESTERASES ARE KEY DETERMINANTS OF THE BIMODAL DISTRIBUTION OF ACYL CHAIN LENGTH OF CUPHEA PALUSTRIS SEED OIL"</p> <p>PLANT PHYSIOLOGY, vol. 110, 1996, pages 203-210, XP002014020 see page 209, column 2, paragraph 2</p> <p style="text-align: center;">---</p>	15,22
A	<p>SLABAUGH, M.B., ET AL.: "Cuphea wrightii beta-ketoacyl-ACP synthase II (CwKASII1) mRNA complete cds."</p> <p>EMBL SEQUENCE ACCESSION NO. U67317, 13 December 1996, XP002081431 see the whole document</p> <p style="text-align: center;">---</p>	15,22
A	<p>FUHRMANN, J., ET AL.: "Factors controlling medium-chain fatty acid synthesis in plastids from maturing Cuphea embryos"</p> <p>Z. NATURFORSCH., vol. 48c, 1993, pages 616-622, XP002081432 see the whole document</p> <p style="text-align: center;">---</p>	15,22
A	<p>SCHUCH, R., ET AL.: "Medium-chain acyl-ACP thioesterase is not the exclusive enzyme responsible for early chain-length termination in medium-chain fatty acid synthesis"</p> <p>GRASAS Y ACEITES, vol. 44, 1993, pages 126-128, XP002081433 see the whole document</p> <p style="text-align: center;">---</p>	15,22
A	<p>TOEPFER R ET AL: "MODIFICATION OF PLANT LIPID SYNTHESIS"</p> <p>SCIENCE, vol. 268, 5 May 1995, pages 681-685, XP002014017 see page 684, column 3, paragraph 2</p> <p style="text-align: center;">---</p>	15,22
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INTERNATIONAL SEARCH REPORT

International Application No

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 94 10189 A (CALGENE INC) 11 May 1994 see page 5, line 34 - line 36 ---	15,22
A	WO 92 03564 A (CALGENE INC) 5 March 1992 see page 22, line 19 - line 23 ---	15,22
A	WO 96 23892 A (CALGENE INC ;DEHESH KATAYOON (US); VOELKER TONI ALOIS (US); HAWKIN) 8 August 1996 see the whole document ---	15,22
A	WO 95 13390 A (CALGENE INC ;VOELKER TONI ALOIS (US); YUAN LING (US); KRIDL JEAN () 18 May 1995 see the whole document ---	15,22
A	WO 94 10288 A (CALGENE INC ;VOELKER TONI ALOIS (US); DAVIES HUW MAELOR (US); KNUT) 11 May 1994 see the whole document ---	15,22
A	WO 92 20236 A (CALGENE INC) 26 November 1992 see the whole document ---	15,22
A	VOELKER, T.A., ET AL.: "Genetic engineering of a quantitative trait: metabolic and genetic parameters influencing the accumulation of laurate in rapeseed." THE PLANT JOURNAL, vol. 9, no. 2, 1996, pages 229-241, XP002081434 see the whole document ---	15,22
A	WO 93 10240 A (DU PONT) 27 May 1993 see the whole document ---	15,22
A	WO 95 15387 A (CALGENE INC ;METZ JAMES GEORGE (US); LARDIZABAL KATHRYN DENNIS (US) 8 June 1995 see the whole document ---	15,22
T	DEHESH, K., ET AL.: "KAS IV: a 3-ketoacyl-ACP synthase from Cuphea sp. is a medium chain specific condensing enzyme" THE PLANT JOURNAL, vol. 15, no. 3, August 1998, pages 383-390, XP002081435 see the whole document -----	15,22, 29-32

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 98/ 07114

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
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Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Claims Nos.: 1-14,19,20,21,26,27,28

Remark : Claims 1-14 were not provided to the ISA at the time of search and hence the subject matter of these claims and the dependent claims 19,20, 21,26,27,28, could not be defined.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. J. Application No

PCT/US 98/07114

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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Int. Jonal Application No

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